Endovascular Treatment of a Distal Aneurysm of the Superior Cerebellar Artery by Intra-Aneurysmal Injection of Glue

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Summary

Aneurysms in the distal cerebellar arteries are rare events. They are associated with a poor prognosis, as surgery or embolisation with Guglielmi detachable coils (GDCs) is very difficult. The ability to treat them surgically depends on the location of the aneurysm, but surgery is considered difficult and is associated with a high morbidity/mortality rate.

Embolisation with GDCs may be difficult or impossible because of the distal location of the aneurysm or the unfavourable ratio between the size of the aneurysm and the size of the parent vessel.

We report our experience in one case treated with intra-aneurysmal injection of glue.

The aneurysm, located in the distal right superior cerebellar artery, was catheterized with a flow-guided microcatheter, and glue was slowly injected into the aneurysmal sac.

The treatment resulted in total occlusion of the aneurysm with preservation of the parent artery.

Introduction

Aneurysms of the distal superior cerebellar artery (SCA) are rare events. Locksley et al[7], in a series of 2349 intracranial aneurysms, found six aneurysms of the SCA (0.3%). Gacs et al[5], in a surgical series of 910 vertebrobasilar aneurysms, reported six distal aneurysms of the SCA (0.7%).

The ability to treat them surgically depends on the location of the aneurysm, but surgery is considered difficult and is associated with a rather high morbidity/mortality rate [1,10]. Embolization with Guglielmi detachable coils (GDCs, Target Therapeutics, Fremont, CA) may be difficult or impossible:

- first, it can be difficult to catheterize the aneurysm with the microcatheters we normally use for this purpose, the Excel 14 or the Tracker 10 (Target Therapeutics), owing to the very distal location of the aneurysm;

- second, because of the large width of the aneurysmal neck and the small diameter of the parent artery, occlusion of the aneurysm with GDCs would most likely result in a thrombosis of the parent vessel, due to its catheterization or protrusion of the coils;

- third, this kind of aneurysm often shows a very irregular shape that is not likely to adapt itself to the coil bulging.

We report our experience in one case of distal right SCA aneurysm treated with intra-aneurysmal injection of glue, with the technique previously described (in 1999) by Cognard et al[3] in three patients.

Case Report

A 44-year-old woman sought medical attention for frequent headaches. CT examination disclosed a "suspect right perimesencephalic aneurysmatic malformation". Findings at neurologic examination were normal.

Cerebral angiography confirmed a distal right SCA aneurysm (figure. 1A,2A,3A); angiography revealed a significant contrast stagnation (figure 1B). The shape was quite irregular, with a "pseudomycotic" aspect. Initially, endovascular treatment with GDCs was considered, but we anticipated several problems with that technique because of the distal location of the aneurysm and the unfavorable ratio between the size of the aneurysm and the size of the parent vessel and its irregular shape made packing of the aneurysm using coils difficult and unsafe.

Consequently, we decided to perform an endovascular treatment with injection of glue.

A 6F guiding catheter was introduced, with its tip placed in the left vertebral artery. Through the guiding catheter, the distal superior cerebellar artery was catheterized with a flow-guided Flowrider 1.8 microcatheter (Micro Therapeutics, Irvine, CA) directed by a Silver Speed 0.010F microguidewire (Micro Therapeutics). The tip of the microcatheter was gently introduced into the aneurysm. A mixture of 1 ml Histoacryl (Braun, Melsungen, Germany) and 2 ml of iodized oil (Lipiodol, Andre Guerbert, Aulnay sous Bois, France) was prepared in a 3 ml Luer-Lock syringe and very slowly injected into the aneurysm. Control angiography (figure 1C,D, 2B,C, 3B,C) showed occlusion of the aneurysm with preservation of the parent artery and normal flow in the distal hemispheric branch. A small remnant of the aneurysm was seen at the level of the neck. After awakening from anesthesia, the patient was asymptomatic and was discharged five days later. Follow-up angiography at three months showed complete occlusion of the aneurysm with no visible neck remnant. The patient is scheduled for a three-year follow-up angiogram to confirm the stability of the outcome.

Discussion and Conclusion

Aneurysms located in the distal intracranial vessels are rare. Distal aneurysms represent approximately 7% to 9% of anterior cerebral artery aneurysms and 2% to 7% of middle cerebral artery aneurysms. Regarding the distal segments of the cerebellar artery, Locksley et al[7], in a series of 2349 intracranial aneurysms, found six aneurysms of the SCA (0.3%) and 11 of the PICA (0.5%). Gacs et al[5], in a surgical series of 910 vertebrobasilar aneurysms, reported six distal aneurysms of the SCA (0.7%) and eight aneurysms of the PICA (0.9%).

The poor prognosis in patients with ruptured intracranial aneurysms of the posterior circulation was documented in 1995 by Schievink et al[8]. In their series, the 48-hour survival rate was 32% for aneurysms of the posterior circulation and 77% for aneurysms of the anterior circulation.

Outcome after surgery, depending on the location of the aneurysm, has been reported by several investigators. Gacs et al[5] reported 16 patients with distal cerebellar aneurysms, all of whom were in good clinical condition when they underwent surgery. The final outcome was considered excellent or good in 11 cases (69%) and poor in four cases (25%).

Since the introduction of GDCs, it is generally believed that ruptured or unruptured aneurysms in the posterior circulation may be treated with GDCs, with a lower morbidity / mortality risk than surgery. The main limitation to this treatment is the morphology of the aneurysm, the presence of a wide neck being the most important limitation.

In our case of distal SCA aneurysms, we judged GDC treatment to be unsuitable for the reasons previously described. We decided to perform the endovascular treatment with the technique described by Cognard et al[3]. This technique consists in intra-aneurysmal injection of glue, after catheterization using a flow-guided microcatheter, with the over-the-wire approach.

Several authors have reported the results of experimentally occluded aneurysms using cyanoacrylate, either by direct puncture of the aneurysm or by an endovascular approach[6,9]. The major drawback reported in these studies has been the large number of distal embolizations of cyanoacrylate into normal vessels.

Fox et al[4] reported the results from three patients with cerebral aneurysms who were treated with isobutyl 2-cyanoacrylate combined with calibrated-leak balloons. All treatments resulted in major infarction and death. Szikora

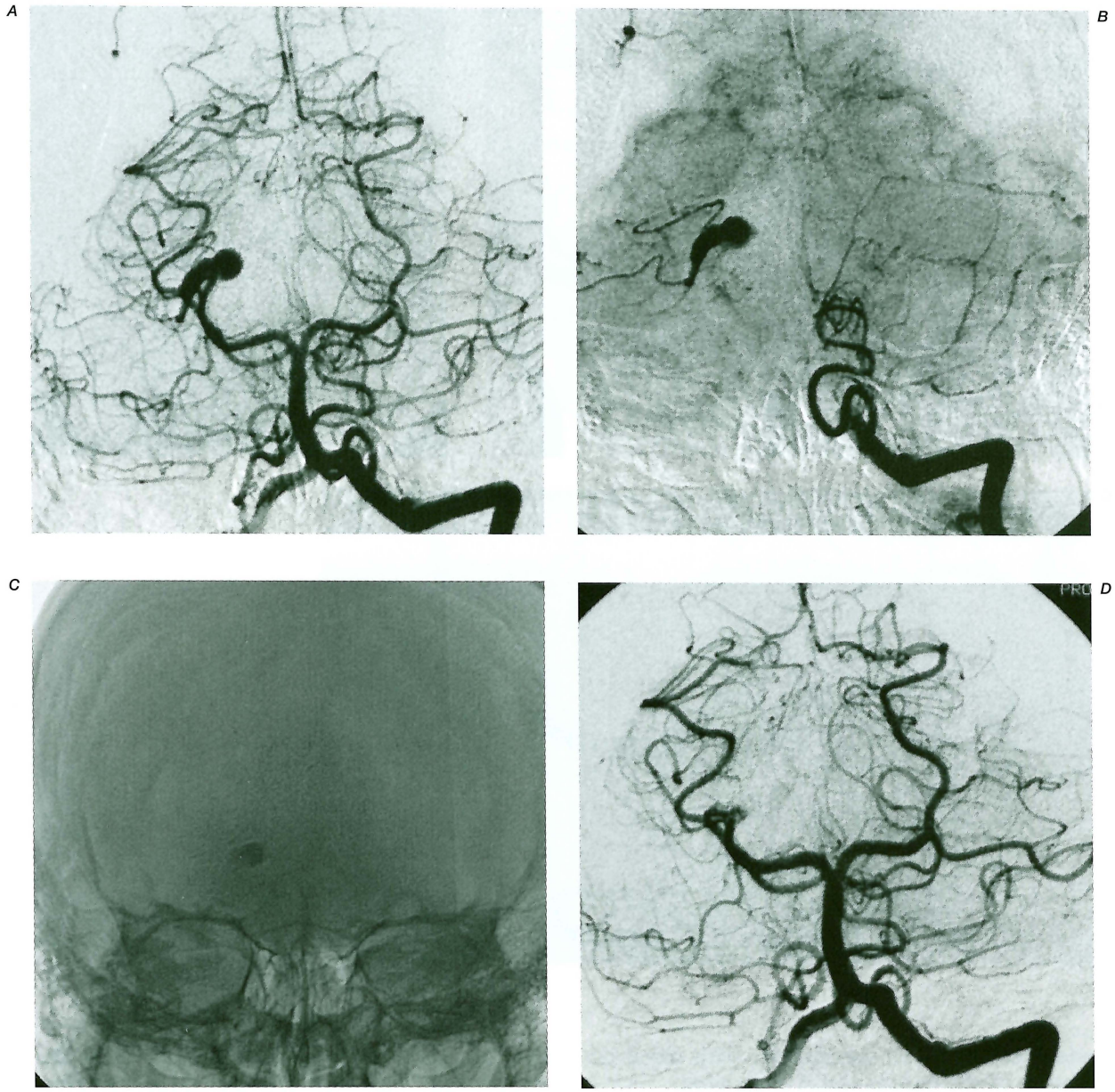

Figure 1 A) Left vertebral injection, anteroposterior view, shows distal aneurysm located in the hemispheric branch of the right superior cerebellar artery. B) Left vertebral injection, anteroposterior view, late phase, shows the contrast stagnation in the aneurysm. C) Postembolization anteroposterior view, shows the glue shaped in the aneurysmal sac. D) Postembolization, left vertebral injection, anteroposterior view, shows the occlusion of the aneurysm with preservation of the parent artery and normal flow in the distal hemispheric branch; a small remnant of the aneurysm was seen at the level of the neck.

et al [11] reported good results from the injection of N-hexyl-cyanoacrylate in experimental aneurysms under the protection of a stent previously deposited in the parent artery.

The stent allowed good control of the blood flow inside the aneurysms and thus safer filling of glue inside the aneurysm. Other authors reported good results in vivo with the peripheral occlusion of the parent vessel, close to the aneurysms, using glue.

The well-known report by Garcia-Monaco et al in 1993 highlighted the importance of using free flow glue on the artery feeding the pseudoaneuryms in ruptured intracranial arteriovenous malformations. Finally, Chaloupka et al [2] described two cases of distal SCA

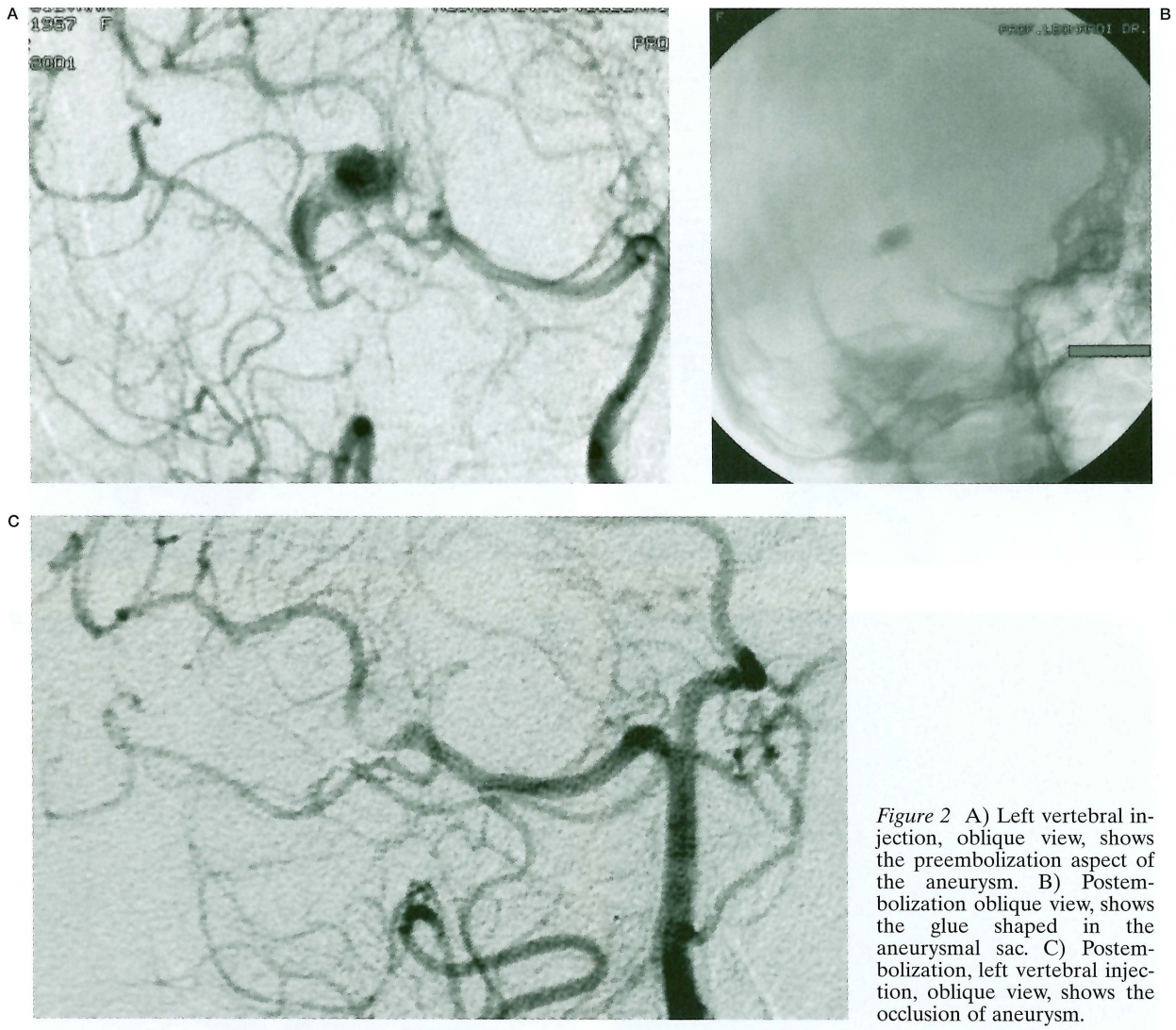

Figure 2 A) Left vertebral injection, oblique view, shows the preembolization aspect of the aneurysm. B) Postembolization oblique view, shows the glue shaped in the aneurysmal sac. C) Postembolization, left vertebral injection, oblique view, shows the occlusion of aneurysm.

aneurysms, treated successfully with distal occlusion of the parent vessel using glue.

In accordance with Cognard [3], some aspects of the technique merit attention.

Microcatheterization. The technique allows easy and safe catheterization of an aneurysm using a flow-guided microcatheter, because of the flexible and atraumatic tip. It was performed with the use of a Flow Rider flow-guided microcatheter directed by a 0.010F Silver Speed microguidewire. The tip of the microcatheter, shaped with steam, was placed inside the aneurysm and kept there. The microcatheter was slowly pushed over the wire, with the tip never coming into contact with the aneurysma1 wall. With this technique, catheterization of the aneurysmal sac is completely atraumatic. In our case, the microcatheterization was quite easy and safe.

The aim of embolization. It was initially to occlude the aneurysm and the parent artery in front of the aneurysmal neck. Otherwise, the proximal portion of the SCA, as well as the perforating arteries arising from these arterial segments, would remain patent and the distal segments of the SCA would be retrogradely vascularized from the very rich pial collateral circulation. The slow injection of contrast material inside the aneurysm allowed us to obtain

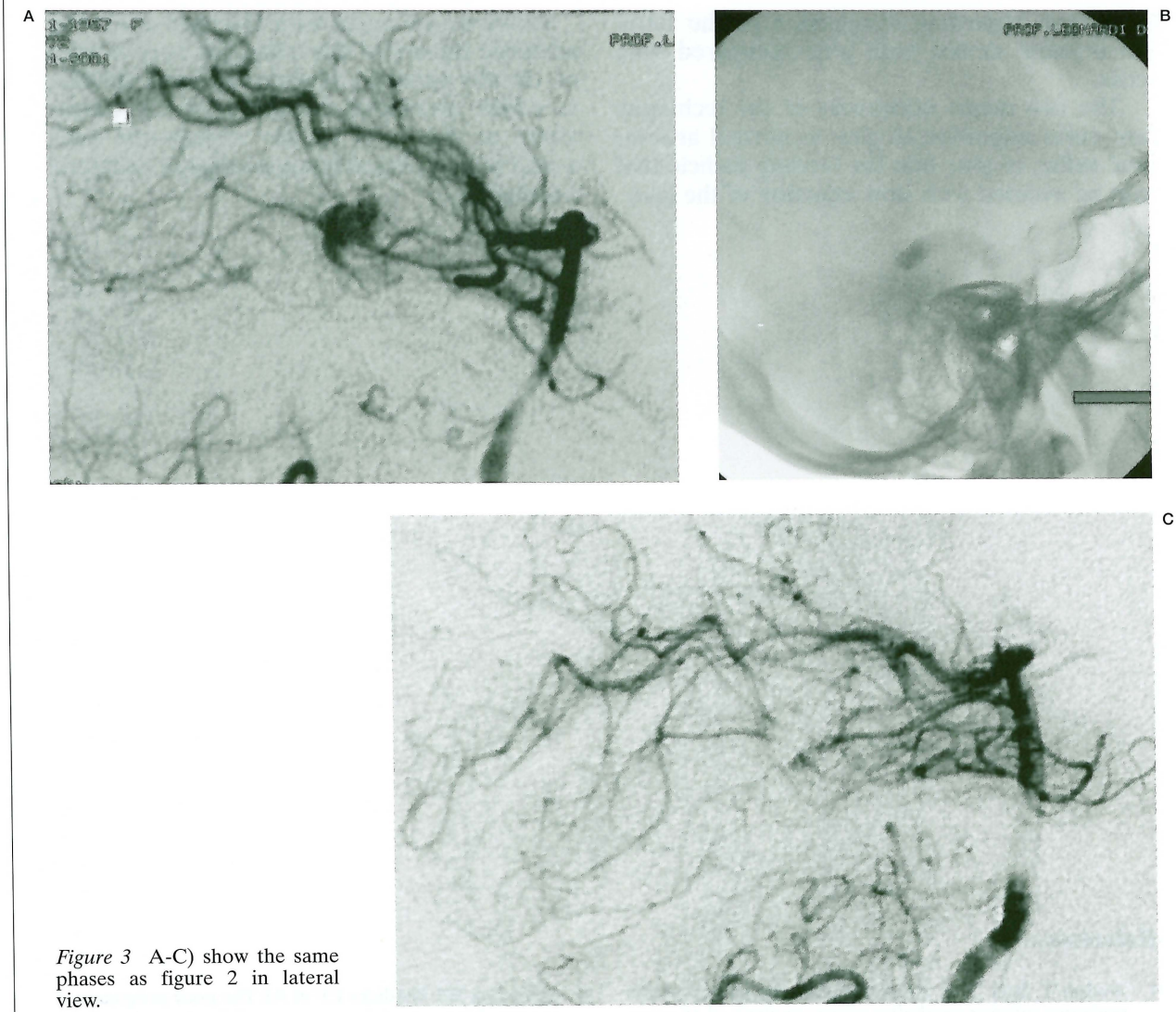

Figure 3 A-C) show the same phases as figure 2 in lateral view.

progressive filling of the aneurysm. This good control of flow inside the aneurysm encouraged us to glue the aneurysm alone and try to preserve the parent artery.

The glue solution and injection. The glue solution (a mixture of 1 ml Histoacryl and 2 ml Lipiodol) was injected very slowly with a 3-mL Luer-Lok syringe resulting in all cases in complete occlusion of the aneurysm with preservation of the parent artery and normal flow in the distal hemispheric branches.

The mixture we used allows us to inject the glue slowly with good control of the polymerization. As when embolizing direct fistulas in cases of brain AVMs, the tip of the microcatheter should be in contact with the wall of the aneurysm (the vessel in cases of AVMs). Because of this contact, the first drop of glue will stick to the wall. Very slow injection of the glue will allow the collected mass to progress along and stick to the entire wall of the aneurysm, thus enabling complete filling of the aneurysm while preserving the parent artery.

Potential drawbacks. The risk of rupture of the aneurysm during this kind of embolization is extremely low, primarily because the glue is injected very slowly into the aneurysm and secondarily because no manipulation is required compared with the GDC technique.

We would expect even fewer problems in the

long-term regarding compaction of the intra-aneurysmal device with glue compared with coils.

The two major drawbacks of the technique are distal migration of glue to normal arteries and reflux of glue into the feeding pedicle that can be avoided with slow injection of the glue.

However, we agree with Cognard et al. who advocate the use of this technique only in cases of distally located aneurysms in small arteries, in which accidental occlusion of the parent artery at the level of the aneurysmal neck would not be critical because of good collateral circulation.

References

1 Andoh T, Itoh T et Al: Peripheral aneurysms of the posterior inferior cerebellar artery: analysis of 15 cases. No Shinkei Geka 20: 683-690, 1992.

2 Chaloupka JC, Putman M, Awad IA: Endovascular therapeutic approach to peripheral aneurysms of the superior cerebellar artery. Am J Neuroradiol 17: 1338-1342, 1996.

3 Cognard C, Weill A et Al: Treatment of distal aneurysms of the cerebellar arteries by intraaneurysmal injection of glue. Am J Neuroradiol 20: 780-784, 1999.

4 Fox AJ: Detachable calibrated leak balloon with IBCA/NBCA for treatment of aneurysm. Am J Neuroradiol 13: 1452-1453, 1992.

5 Gacs G, Vinuela F et Al: Peripheral aneurysms of the cerebellar arteries: review of 16 cases. J Neurosurg 58: 63-68, 1983.

6 Kerber CW, Cromwell LD, Zanetti PH: Endovascular treatment with cyanoacrylate. Neurosurgery 16: 13-17, 1985.

7 Locksley HB: Report on the cooperative study of intracranial aneurysms and subarachnoid hemorrhage, section V, part I: natural history of subarachnoid hemorrhage, intracranial anurysms and arterio-venous malformations; based on 6368 cases in the cooperative study. J Neurosurg 25: 219-239, 1966.

8 Schievink WI, Wijdicks EF et Al: The poor prognosis of ruptured intracranial aneurysms of the posterior circulatjon. J Neurosurg 82: 791-795, 1995.

9 Sheptak PE, Zanetti PH, Susen AE: The treatment of intracranial aneurysms by injection of a tissue adhesive. Neurosurgery 1: 25-29, 1977.

10 Spallone A, De Santis S, Giuffre R: Peripheral aneurysms of the anterior inferior cerebellar artery: case report and review of literature, Br J Neurosurg 9: 537-541, 1995.

11 Szikora I, Guterman LR et Al: Endovascular treatment of experimental aneurysms with liquid polymers: the protective potential of stents. Neurosurgery 38: 339-347, 1996.

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